<u>**In the Specification**</u>

Please substitute the first paragraph on page 33 through the third paragraph on page 34 with the following paragraphs.

For this approximate physical model, we consider the substrate as three equal layers each of thickness $\Delta h/3$. We estimate the temperature rise of the top, directly heated layer and then compare this to an estimate of the heat transferred through the middle layer to the back layer to give an upper value for the exposure time t_E to the heat flux that gives a large temperature differential through the thickness. If the top layer were thermally isolated, equation (6) gives the temperature rise ΔT for the exposure time t_E with an input heating power W to the top layer of thickness $\Delta h/3$ as:

(14) $\Delta T = 3W\, t_E / \rho\, c_p \Delta h$

We now estimate the heat transferred through the middle layer, thickness $\Delta h/3$, to the back layer during the exposure time t_E. We use equation (15) to estimate the temperature difference across the middle layer as $\Delta T/$<u>2</u>~~4 (e.g., ~$\Delta T/2$ for the top layer, ~½($\Delta T/2$) for both middle and bottom layers~~. <u>For there to be a large temperature difference through the wafer thickness when exposure to the heat flux has ended, the heat transferred to the back layer must be significantly smaller than the heat input into the front surface. Since the back layer is one third the total wafer thickness we use:</u>

<u>Heat transfer rate to back layer = (1/2)(W/3) = W/6</u>

<u>as an upper value for estimating onset of the regime for a large temperature difference.</u> Equation (13) then gives for the heat transfer rate through the middle layer to the back layer as:

$$(\text{area})\ W/\underline{6} = k\ (\text{area})\ (\Delta T/\underline{2}4)\ /\ (\Delta h/3)$$

(15) $W = \underline{9}\cancel{(3/4)}k\Delta T/\Delta h$

Substituting for ΔT from equation (14) and solving for t_E gives the estimate for the upper bound to the exposure time for the regime with a large temperature differential as:

(16) $t_E < \cancel{(4/9)}\rho\ c_p\Delta h^2\ /\ \underline{27}k$

We note that this expression does not explicitly contain the input heating power; however since the heat capacity c_p and the thermal conductivity k are somewhat temperature dependent for all materials there is an implicit dependence on the heat input by way of the temperature dependence of these variables.

For the case of a silicon wafer for heating to a peak temperature above 1200 degrees C, representative values for the variables in (16) are: $\rho = 2.33\text{x}10^3$ Kg/m^3; c_p = 700 J/(kg degrees C); $\Delta h = .75\text{x}10^{-3}$m and k = 40 W/(m degrees C) which give: